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The Position of Bitumen Emulsions on Different Bases

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Extended Abstract

Fast and durable repair of asphalt roads is important for a functioning infrastructure. An important method is the milling of the old asphalt layer in order to place a new layer on top ("hot on cold" paving). A bitumen emulsion is used as an adhesion primer. The adhesion of the materials due to the emulsion at the layer boundary is intended to improve the bond and thus dissipate the stresses that occur due to traffic loading [1]-[3]. For this purpose, it is necessary to choose the correct quantity of spray [4]-[5] and to distribute it uniformly. Bitumen emulsion consists of bitumen, water and an emulsifier. The emulsifier causes the fine bitumen droplets to spread in a stable state in the water [6]. After spraying, the bitumen emulsion breaks and the water evaporates [7]. To determine the location of bitumen emulsion in this study, a C40 B5-S (40-wt.% content of bitumen) was sprayed onto the different bases using a specially designed spray-on system (spray-on quantities: 225 g/m^2; 450 g/m^2). The surfaces of the two variants differ in the texture of the surface and in the void content on the surface (dense surface (milled); open-pore surface (asphalt texture)). The aim of this study was to determine the position of bitumen emulsion on theses surfaces using the X-ray computed micro tomography (µ-CT) technique. Tis technique allows 3D imaging of structures by measuring different densities [8]. For the analysis of the thin layers of the bitumen emulsion, a high-density tracer (barium sulfate) was added, which had no interfering effect on the viscosity of the bitumen emulsion. This made it possible to identify the bitumen emulsion in the subsequent analysis due to the difference in density.[9]. The (sprayed) samples were measured using a high-resolution µ-CT (type: Zeiss Xradia 520 Versa). The measurements were performed with a voltage of 140 kV and a power of 10 watts. The spatial resolution was 34.5 µm.

The results of the measurements with the µ-CT showed that the distribution of the bitumen emulsion on a milled surface is uneven. In the deepening's of the structure, an emulsion thickness of 917 µm could be measured. Further there was only a small amount of bitumen emulsion on the crests and slopes compared to the deepening's (measured thickness: 217 µm). For the samples with the asphalt surface the bitumen emulsion flows into the voids and was collected there. Almost no emulsion was detected at the actual layer boundary.

From the results it can be concluded that the distribution is not optimal and thus no optimal bonding is achieved. For this reason, in further studies the bitumen emulsion will be adjusted in terms of viscosity to achieve a more uniform distribution. This study showed that a new understanding of the material can be obtained with 3D imaging, allowing optimization steps to be applied that lead to better material behavior.

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